MICROFICHED

V08021

WJ-8615

FREQUENCY EXTENDER

WATKINS-JOHNSON

WJ-8615

FREQUENCY EXTENDER

WATKINS-JOHNSON COMPANY
700 Quince Orchard Road
Gaithersburg, Maryland 20878

November 1985

WARNING

This unit employs voltages that are dangerous and may be fatal if contacted. Exercise extreme caution when working on this unit with any of the protective covers removed.

PROPRIETARY STATEMENT

This document and subject matter disclosed herein are proprietary items to which Watkins-Johnson Company retains the exclusive right of dissemination, reproduction, manufacture and sale.

This document is provided to the individual or using organization, for their use alone in the direct support of the associated equipment, unless permission for further disclosure is expressly granted in writing.

TABLE OF CONTENTS

Paragraph		Page
1.1	General Description	1-1
1.1.1	List of Parts Supplied	1-1
1.2	Installation	1-1
1.3	Circuit Description	1-2
1.3.1	Functional Description	1-2
1.3.2	Detailed Circuit Description	1-3
1.3.2.1	Type 280899-1 RF Switch Assembly (A3A2)	1-3
1.3.2.2	Type 796414-1 UHF Preselector (A3A1A1)	1-3
1.3.2.3	Type 796415-1 UHF Preamplifier/Mixer (A3A1A2)	1-4
1.3.2.4	Type 798079-2 UHF LO Synthesizer (A3A1A3)	1-6
1.3.2.5	Part 390421-1 UHF Variable Divider (A3A1A3A1)	1-6
1.4	Alignment	1-7
1.5	Performance Test	1-8
1.6	List of Manufacturers	1-9
1.7	Replacement Parts List	1-10
1.7.1	Type 796456-1 Frequency Extender (A3)	1-13
1.7.1.1	Type 380762-1 Motherboard (A3A1)	1-15
1.7.1.1.1	Type 796414-1 UHF Preselector (A3A1A1)	1-16
1.7.1.1.2	Type 796415-1 UHF Preamplifier/Mixer (A3A1A2)	1-19
1.7.1.1.3	Type 798079-2 UHF LO Synthesizer (A3A1A3)	1-23
1.7.1.1.3.1	Type 390421-1 UHF Variable Divider (A3A1A3A1)	1-24
1.7.2	Type 280899-1 RF Switch (A3A2)	1-27

LIST OF ILLUSTRATIONS

Figure		Page
1-1	WJ-8615 Frequency Extender	1-0
1-2	WJ-8615 FE Left Side Component View	1-11
1-3	WJ-8615 FE Right Side Component View	1-12
1-4	Type 380762-1 Motherboard (A3A1), Location of Components	1-14
1-5	Type 796414-1 UHF Preselector (A3A1A1), Location of Components	1-17
1-6	Type 796415-1 Preamplifier/Mixer (A3A1A2), Location of Components	1-20
1-7	Type 798079-2 UHF LO Synthesizer (A3A1A3), Location of Components	1-22
1-8	Type 390421-1 UHF Variable Divider (A3A1A3A1), Location of Components	1-26
1-9	Type 280899-1 RF Switch (A3A2), Location of Components	1-28
1-10	Type 380762-1 Motherboard (A3A1), Schematic Diagram 480562	1-29
1-11	Type 796414-1 UHF Preselector (A3A1A1), Schematic Diagram 480604	1-31
1-12	Type 796415-1 UHF Preamplifier/Mixer (A3A1A2), Schematic Diagram 480592	1-33
1-13	Type 798079-2 UHF LO Synthesizer (A3A1A3), Schematic Diagram 590163	1-35
1-14	Type 280899-1 RF Switch (A3A2), Schematic Diagram 480653	1-37
1-15	Type 796456-1 Frequency Extender Main Chassis (A3), Schematic Diagram 480651	1-39

TABLE OF CONTENTS

LIST OF TABLES

Table		Page
1-1	UHF Preselector Bandpass Selection Table	1-4
1-2	UHF Tuning Table	1-5

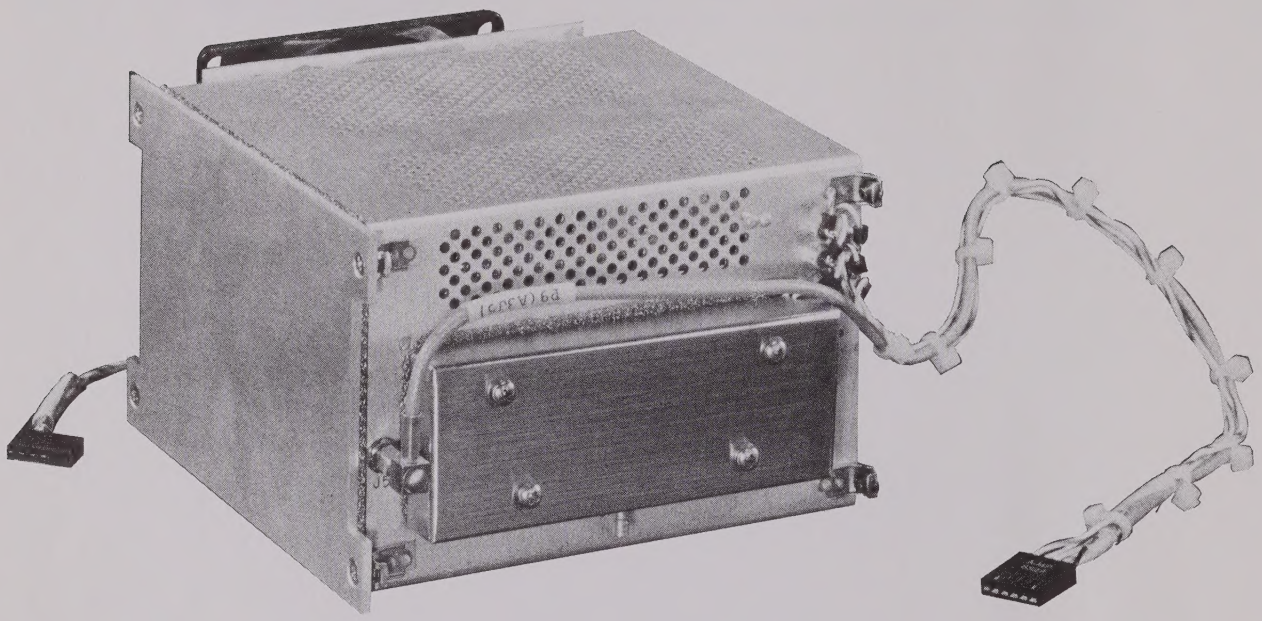


Figure 1-1. WJ-8615 Frequency Extender

WJ-8615 FREQUENCY EXTENDER

1.1 GENERAL DESCRIPTION

This 500-1100 MHz Frequency Extender (FE) is composed of the UHF Preselector (A3A1A1) Type 796414-1, the UHF Preamplifier Mixer (A3A1A2) Type 796415-1, the UHF LO Synthesizer (A3A1A3) Type 798079-2 and the RF Switch (A3A2) Type 280899-1. All of these subassemblies install in the Motherboard Assembly (A3A1). These subassemblies provide an extension of the receiver tuning range from 500 MHz up to 1100 MHz. When the receiver is tuned to frequencies within the extended frequency range (500-1100 MHz) the received signal is mixed with one of four fixed LO frequencies. The difference frequency (the result of down conversion) is within the VHF tuning range of the receiver. The receiver is tuned to the difference frequency.

1.1.1 LIST OF PARTS SUPPLIED

The following items are included as part of the Frequency Extender Type 796303-1.

Item	Ref. Designation	Type	Qty.
A3	FE Option	796456-1	1
A3A1	Motherboard	380762-1	1
A3A1A1	UHF Preselector	796414-1	1
A3A1A2	UHF Preamp/Mixer	796415-1	1
A3A1A3	UHF LO Synth.	798079-2	1
A3A1A3A1	UHF Var. Divider	390421-1	1
A3A2	RF Switch	280899-1	1

These items are included with the Frequency Extender. Replacement parts for these subassemblies are listed in **paragraph 1.7.**

1.2 INSTALLATION

Installation of the Frequency Extender option can be performed by following the procedure below.

CAUTION

When installing the Frequency Extender (FE) Option, special precautions should be taken to prevent the possibility of damaging the UHF Preselector and UHF Preamp/Mixer subassemblies. Two different versions of the FE Option exist. Subassemblies from one version MUST NOT be mixed with the other version. Use only Type 794111-1 UHF Preselector (A3A1A1) with Type 798075-1 UHF Preamp/Mixer (A3A1A2) or Type 796414-1 UHF Preselector (A3A1A1) with Type 796415-1 Preamp/Mixer (A3A1A2). Interchanging the different version types could result in physical damage to the subassemblies.

Installation Procedure:

1) Remove the screws securing the rear panel and extend the rear panel.

2) Remove the fan, its mounting bracket and mount the fan onto the fan bracket supplied with the Frequency Extender (FE).

3) Remove the middle support bracket. Carefully move the cables near the bracket to allow its removal.

4) Install the supplied support bracket and put the spacer for Aux. Connector J13 behind the connector.

5) Unlace the cable bundle, on the bottom of the unit. Remove the cable to J6 and replace it with the supplied connector cable.

6) Unlace the cable to A1A14J1. Install the fan and FE subassembly. To secure the end plate to the FE subassembly put the screws through the side of the unit far enough to hold the plate in place. Then align the screw holes in the subassembly and secure with the remaining screws.

7) Connect P1 to J1 and P7 to J7. Existing cabling may have to be carefully moved. Connect A1A14 to the FE subassembly and connect the FE output cable to A1A14.

8) Relace the wire bundles and reconnect the rear panel to the unit.

1.3 CIRCUIT DESCRIPTION

1.3.1 FUNCTIONAL DESCRIPTION

With the FE Option installed, the 20-500 MHz output from the RF Switch (A3A2) is applied to a VHF/UHF select switch in the Type 796415-1 UHF Preamplifier/Mixer (A3A1A2), and the 500-1100 MHz RF Switch output is applied to the input of the UHF Preselector (A3A1A1) Type 796414-1. Refer to **Figure 1-15** for the WJ-8615 Frequency Extender Main Chassis schematic diagram.

When the receiver is tuned to frequencies above 500 MHz, the incoming signals are applied from the 500-1100 MHz output of the RF Switch to the input of the UHF Preselector (A3A1A1). The UHF Preselector divides the 500 to 1100 MHz RF frequency range into 4 bands (500 to 599, 600 to 699, 700 to 899 and 900-1100 MHz). Switching between bands is accomplished via the PIN diode switching network, which applies the signal through the selected bandpass filter, determined by the tuned frequency of the receiver. The control signals from the UHF LO Synthesizer (A3A1A3) provide bias current to the PIN diode switching network to accomplish switching between the preselector bands as the UHF LO Synthesizer is tuned.

From the UHF Preselector, the RF signal is applied to the UHF Preamplifier/Mixer (A3A1A2), where the signal is amplified and mixed with the LO signal provided by the UHF LO Synthesizer (A3A1A3) producing an output frequency within the VHF frequency range. A

voltage controlled attenuator (U2) within UHF Preamplifier/Mixer provides automatic gain control (AGC) for this subassembly. U2 receives a dc bias voltage from the AGC circuitry of the receiver which varies with respect to the strength of the received signal, thus controlling the overall gain of the FE Option. The amount of attenuation introduced by U2 varies directly with the strength of the tuned signal providing a relatively constant signal to the mixer (U3). From the mixer, the down converted signal is applied to the receiver via the UHF/VHF select switch in the output circuitry of the UHF Preamplifier/Mixer.

When the receiver is tuned to 500 MHz or less, the UHF/VHF switch, at the output of the UHF Preamplifier, switches to provide a signal path from the 20-500 MHz RF Switch output to the VHF section of the receiver. At this time, the output from the UHF section is cut off.

1.3.2 DETAILED CIRCUIT DESCRIPTION

1.3.2.1 Type 280899-1 Switch Assembly (A3A2)

The reference designation for this subassembly is A3A2. Refer to **Figure 1-14** for the Type 280899-1 RF Switch schematic diagram.

RF Switch (A3A2) Type 280899-1 receives input RF signals from the Antenna Input (J1). Received RF signals are capacitive coupled through C7 and C9 to the two filter branches. One branch, consisting of L6 and L7, C10 through C15 and their associated components, forms the VHF (500-1100 MHz) bandpass filter. Filter branch selection is accomplished via voltages from the Motherboard (A3A1) applied to E1 and E2 of the RF Switch Assembly. When the receiver tuned frequencies are from 20 to 500 MHz a +15 Vdc is applied to E1 of the RF switch. At the same time a -10 Vdc is applied to E2. Applying a +15 Vdc to E1, of the RF Switch (A3A2), forward biases CR3 and allows the received RF signal to flow through the VHF filter branch and to J2 of the UHF Preamplifier/Mixer (A3A1A2). While the +15 Vdc is applied to E1 a -10 Vdc is applied to E2. This -10 Vdc reverse biases CR4 and prohibits signal flow through the UHF bandpass filter branch. Tuning the receiver to frequencies from 500-1100 MHz causes the voltages applied to E1 and E2 to be reversed. The -10 Vdc on E1 inhibits the flow of signals through the VHF branch by reverse biasing CR3. The +15 Vdc applied to E2 forward biases CR4 and permits UHF signals to be passed through the UHF bandpass filter branch.

1.3.2.2 Type 796414-1 UHF Preselector (A3A1A1)

The reference designation for this subassembly is A3A1A1. Refer to **Figure 1-11** for the Type 796414-1 UHF Preselector schematic diagram.

The Type 796414-1 UHF Preselector (A3A1A1) provides the first stage of RF preselection for the 500-1100 MHz UHF signals. This subassembly utilizes three bandpass filters (FL1 through FL3) dividing the UHF spectrum into three bands: 500-700, 700-900 and 900-1100 MHz. Each bandpass filter is essentially flat over its specified frequency and passes these frequencies with minimum attenuation (0.5 dB). Frequencies out of the filter bandpass are attenuated, thus improving image frequency and IF rejection. The RF signal enters the UHF preselector via P1 of cable W1 and is coupled by C1 to the PIN diode switching network comprised of CR1 through CR14. This switching network applies the signal of interest through

the appropriate bandpass filter, according to the tuned frequency of the receiver. From the filter, the RF signal is coupled through C12 to the output (P2 of W2).

Switching of the RF signal through the proper filter is controlled by the Band $\overline{A}$, $\overline{B}$ and $\overline{C}$ select inputs. Dependent upon the tuned frequency, the Band $\overline{A}$, $\overline{B}$, or $\overline{C}$ select is placed at -10 Vdc providing a current-sink through its respective series input and output PIN diodes. When conducting, the diodes provide a minimum impedance path for the RF signal through the filter within the selected branch. The remaining select inputs are held at +15 Vdc which provides a current source for the shunt diodes in their switch branch. The series diodes in these branches are cut off, thus blocking the RF signal path. The select inputs required to activate each filter branch are illustrated in the UHF Preselector Bandpass Selection Table (**Table 1-1**). Each of the select inputs are provided by the Digital Control Section, automatically selecting the proper filter for the frequency tuned.

Table 1-1. UHF Preselector Bandpass Selection Table

SELECT UHF/VHF	$\overline{C}$	$\overline{B}$	$\overline{A}$	ACTIVE FILTER	BANDPASS (MHz)
0	1	1	1	---	---
1	1	1	0	FL1	500 - 700
1	1	0	1	FL2	700 - 900
1	0	1	1	FL3	900 - 1100

0 = -10 Vdc
1 = +5 Vdc

Inductors L1 through L8, ferrite beads FB1 through FB12, resistors R1 through R13 and capacitors C2 through C11 and C13 through C18 function as decoupling components. These components prevent RF signals from exiting the UHF Preselector via the select inputs of the subassembly.

1.3.2.3 Type 796415-1 UHF Preamplifier/Mixer (A3A1A2)

The reference designation for this subassembly is A3A1A2. Refer to **Figure 1-12** for the Type 796415-1 UHF Preamplifier/Mixer schematic diagram.

The RF signal from the Type 796414-1 UHF Preselector (A3A1A1) enters the UHF Preamplifier/Mixer (A3A1A2) via RF input connector J1 and is applied to the input of preamplifier U1. U1, a broadband amplifier, provides +15.5 dB of gain to the RF signal increasing the signal to a sufficient level to drive the mixer. Decoupling of the +15 Vdc input to U1 (pin 1) is accomplished by L3 and C5. The output of U1 (pin 4) is then applied to PIN diode attenuator U2 via FL1. FL1 is a 1100 MHz low-pass filter, installed in the signal path to attenuate frequencies above 1100 MHz, thus reducing image noise from U1. Voltage controlled attenuator U2, presents a constant impedance at the output of FL1 and provides a means of limiting the signal level to the mixer under strong signal conditions. The amount of attenuation presented by U2 is dependent on the AGC voltage provided by the AGC circuitry of the receiver applied to terminal 49 of the UHF Preamplifier/Mixer subassembly. This voltage varies from +10 Vdc, when weak signals are present, to +2 Vdc under strong signal conditions. The

attenuation presented by U2 varies between -20 dB, with an AGC voltage of +2 Vdc, to -1.75 dB, with an AGC voltage of +10 Vdc. Operating bias is supplied by +15 Vdc applied to pin 1 via the decoupling network comprised of L4 and C6. Control is supplied by the AGC voltage applied to pin 5. L9, C16 and C17 provide decoupling of the AGC input line.

Double balanced mixer U3 receives the RF signal from U2 and mixes it with an LO signal provided by the UHF LO Synthesizer (A3A1A3) providing a difference frequency within the VHF range. The UHF LO Synthesizer applies one of four different fixed frequencies to the mixer to divide the UHF frequency range into four frequency bands as illustrated in the UHF Tuning Table (**Table 1-2**). The Digital Control Section then tunes the VHF section of the receiver to the mixer output frequency, thus permitting the signal of interest to be further processed. The mixer output from pin 1 of U3 is coupled across dc blocking capacitor C22 and is then applied through a low-pass filter comprised of L10, C26 and C27. This filter suppresses high order harmonics of the UHF LO preventing their radiation from the VHF input (J2). From the low-pass filter, the RF signal is applied to the UHF branch of the UHF/VHF switch.

Table 1-2. UHF Tuning Table

RF TUNED FREQ. (MHz)	LO FREQ (MHz)	MIXER OUTPUT FREQ. (MHz)
500 - 599	848	348 - 249
600 - 699	944	344 - 245
700 - 899	1144	444 - 245
900 - 1100	1344	444 - 244

The UHF/VHF switch, comprised of CR3 through CR6, selects the converted UHF signal from the UHF mixer or the VHF signal from the RF Switch (A3A2), entering at J2. Switching is controlled by the UHF/VHF input (terminal 53) provided by the Digital Control Section. This switching input is at a logic "1" (+5 Vdc) when the receiver is tuned to 500 MHz or above and at a logic "0" (0 Vdc) when tuned below 500 MHz. The UHF/VHF select signal from terminal 53 is applied, via R11, to the inverting input of switch driver U8B and also to the U8A non-inverting input. These switch drivers switch between +15 Vdc and -10 Vdc providing bias current for the PIN diodes in the UHF/VHF switch. With a tuned frequency of 500 MHz or higher, the +5 Vdc level causes the output of U8A to switch to +15 Vdc. This provides a current-source for CR4, causing it to conduct and provides a current path for the converted UHF signal to the output of the subassembly (J4). At this time the output of U8B is at -10 Vdc, providing a current-sink for CR6. This causes CR6 to conduct and series diode CR5 to be cut off, preventing the VHF signal from passing through the switch. With tuned frequencies below 500 MHz, the outputs of U8A and U8B are reversed, causing a signal path for the VHF signal through CR5 and blocking the UHF path by cutting off CR4. The voltage divider formed by R5 and R3 provides a switching reference level of approximately 1.5 Vdc.

Integrated circuits U6 and U7 function as switch drivers for the band select circuitry of the UHF Preselector (A3A1A1). These switch drivers receive the UHF/VHF and the 2^0 and 2^1 UHF select inputs from the Digital Control Section and decode these inputs to select the proper preselector filter as the UHF LO Synthesizer is tuned. The UHF select inputs are applied to the A, B and C inputs of decoder U4, which in turn provides a logic "1" level to the

inverting input of appropriate switch driver (U7B, U6A or U6B). The UHF/VHF input is also applied directly to the non-inverting input of U7A causing the output of U7A to be held at +5 Vdc, whenever UHF is selected by the UHF/VHF select input. The remaining drivers switch according to the logic levels provided at the 2^0 and 2^1 UHF select inputs.

When the receiver is tuned between 500 and 599 MHz, 2^0 and 2^1 are both at a logic "0", causing the Q4 output of U4 to be placed at a logic "1". This level is applied at pin 6 of U6B, via CR2, causing the $\overline{A}$ select output to be switched to -15 Vdc. At frequencies of from 500 to 699 MHz, 2^0 is at logic "1" and 2^1 is at logic "0". This condition causes the Q5 output of U4 to be placed at a logic "1" level. This level is applied at pin 6 of U6B, via CR1, causing the $\overline{A}$ select output to be switched to -15 Vdc. At tuned frequencies of from 700 to 899 MHz, 2^0 is at a logic "0" and 2^1 is at a logic "1", causing the Q6 output of U4 to be placed at a logic "1". The Q6 output level is applied to the inverting input of U6A, causing the $\overline{B}$ output to be switched to -15 Vdc. When frequencies between 900 and 1100 MHz are tuned, both the 2^0 and 2^1 select inputs are at a logic "1" state. This causes the Q7 output of U4 to be placed at a logic "1" state. The Q7 output is applied to the inverting input of U7B, causing the $\overline{C}$ output to be switched to -15 Vdc.

The LO signal provided by the UHF LO Synthesizer is applied to the mixer (U3) via J3 and buffer amplifier U5. U5 receives the LO signal at a level of -3 dBm and provides amplification of +10 dB increasing the signal to a sufficient level to drive mixer U3. L5 and C7 function as decoupling components maintaining a signal ground potential on the +9 Vdc source.

1.3.2.4 Type 798079-2 UHF LO Synthesizer (A3A1A3)

The reference designation for this subassembly is A3A1A3. Refer to **Figure 1-13** for the Type 798079-2 UHF LO Synthesizer schematic diagram.

This subassembly consists of the UHF Variable Divider (A3A1A3A1) and the UHF VCO (A3A1A3U1), which together comprise the phase locked loop of the UHF LO Synthesizer. The inputs consits of the 1 MHz reference, (provided by the Synthesizer Section at J2) the UHF and UHF SEL (2^1, 2^0) select inputs provided by the Digital Control Section. The output provided consists of a fixed LO frequency of 848, 944, 1144 or 1344 MHz at J1 of the 848-1344 MHz Oscillator (U1).

1.3.2.5 Part 390421-1 UHF Variable Divider (A3A1A3A1)

The reference designation for this part is A3A1A3A1. Refer to **Figure 1-13** for the Part 390421-1 schematic diagram.

The Part 390421-1 UHF Variable Divider (A3A1A3A1) provides the tuning control for the 848-1344 MHz Oscillator, (U1). This subassembly decodes the UHF, 2^0 and 2^1 select lines, provided by the Digital Control Section, and utilitzes the decoded data to select the oscillator frequency band and to preset the divide-by-n counters in the phase-locked-loop circuitry.

Control inputs to the Part 390421-1 UHF Variable Divider consist of the UHF 2^0 and 2^1 select input, provided at terminals E1, E2 and E3. The UHF input line, which is set to a logic "1" whenever the receiver is tuned above 500 MHz, is applied to the G input of U8 and to the cathode of CR1 enabling the Variable Divider circuitry. The 2^0 and 2^1 inputs are applied to the A and B inputs of U8 and to gates A and B of U9. U8 and U9 then decode the select inputs

selecting the oscillator frequency band and presetting binary counters U7 and U6. Comparator U5 monitors the output lines of U8 and compares the logic level at each line with a +2.5 Vdc reference, provided by the voltage divider formed by R1 and R2. Each comparator in U5 provides +15 Vdc to the appropriate band select input of oscillator U1 when its respective input (from U8) goes low, causing the desired oscillator band to be selected. The remaining outputs of U5 are held at -15 Vdc, due to the logic "1" at their inverting inputs.

A sample of the output frequency of A3A1A3U1 enters the Variable Divider at E9 and is applied to the input of amplifier U4 via the pad formed by R9, R10 and R11. U4 amplifies the oscillator frequency and applies the signal to the input of U3, via C12. Integrated circuits U3 and U2 provide divide factors of 4 and 2, respectively, providing a total prescaling factor of 8. The prescaled output is then applied to the input of a two modulus counter which further divides the signal by a factor of 10 or 11, as determine by the CRY output of counter U6. When the CRY output is at a logic "0", U1 divides by 11 and when the output is at a logic "1", U1 divides by 10. The output of U1 is then applied as a TTL clock to counters U7 and U6.

Presetable binary counters U7 and U6 function with the two modulus counter U1 providing division factors of 106, 118, 143 or 168. U7 and U6 are preset by the decoded outputs of U8 and U9 and count up from the preset until the maximum count is reached. When the maximum count is reached, a pulse is provided to the phase detector U10 and the CRY output of U7 reloads the counters, restarting the count sequence. U7 determines the total number of counts in each count sequence and U6 determines the number of times U1 divides by 11 or 10.

For example, when a LO frequency of 848 MHz is selected, U7 is preset to "6" and U6 is preset to "9". The total count sequence continues until U7 counts up from "6" to its maximum of "15" and then resets (10 counts). Simultaneous with the count of U7, U6 counts up from its preset of "9" to its maximum of "15" (6 counts). When U6 reaches "15" the CRY output is set to 1 and U6 counting halts until the preset is reloaded. During the first 6 counts (while U6 is counting) U1 divides by a factor of 11. For the remaining 4 counts (until U7 reaches its maximum count) U1 divides by a factor of 10. The total count sequence provides a divide factor of 106 (11x6) + (10x4). This, combined with the division factor of 8 by the prescaler, divides the oscillator output frequency by a factor of 848.

The output of U7 is applied to the phase detector (U10), where the divided signal is compared with the 1 MHz reference signal, provided by the Synthesizer Section of the receiver. The phase detector compares the frequency and phase of the two signals and generates an output representing the difference between the signals. This output is integrated by the loop filter, comprised of Q1, Q2 and associated components, to produce a tuning voltage which retunes the oscillator until the divided signal and the reference signal are equal in both frequency and phase. R18 and C22 determine the bandwidth of the loop filter, and C21 and R19 permit bandwidth adjustment.

1.4 ALIGNMENT

Alignment of the Frequency Extender Option may be performed via the procedure that follows:

1) Using an RF analyzer, connect the RF analyzer reflection test port to the Antenna Input (J1) and the RF analyzer's transmission RF input to J3 of the RF Switch (A3A2). Tune the WJ-8615 to 600 MHz.

2) Observe the displayed response on the RF analyzer. Adjust the analyzer to display a 500 MHz response centered at 450 MHz.

3) Adjust L7 to notch out the frequency at 228 MHz and L6 to notch out the frequency at 337 MHz. (Coil adjustment is accomplished via compressing or spreading the coil turns.)

4) Verify that the roll off from 450 MHz to 350 MHz is a minimum of 30 dB and that the ripple from 200 MHz to 340 MHz is at least 30 dB below the level at 450 MHz.

5) Verify the insertion loss is not greater than 1.5 dB and that the bandpass ripple is not more than 1.75 dB overall.

6) With the RF analyzer transmission RF input connected to A3A2J2, connect the reflection test port to the Antenna Input (J1), tune the WJ-8615 to 400 MHz and observe the displayed response.

7) Adjust L8 and L9 to produce minimum insertion loss and maximum flatness (less than 0.5 dB loss from 400 MHz to 550 MHz).

1.5 PERFORMANCE TEST

After the Frequency Extender Option has been installed, verify proper operation of the frequency extender via the following procedure.

1. Connect a signal generator to the Antenna Input (J1) with a CW output at -20 dBm. Connect a spectrum analyzer to J4 of the Frequency Extender.

2. Tune the signal generator and the receiver to 500 MHz. Set the spectrum analyzer center frequency to 348 MHz. Note the output level displayed on the spectrum analyzer.

3. Tune the receiver and signal generator to the following frequencies and monitor the output frequency and level on the spectrum analyzer. Verify the frequency accuracy (±1 kHz) and the output level gain (+3 to +6 dB gain), compared to the level noted in Step 2.

Tuned Frequency	S.A. Frequency
599 MHz	249 MHz
600 MHz	344 MHz
699 MHz	245 MHz
700 MHz	444 MHz
899 MHz	245 MHz
900 MHz	444 MHz
1100 MHz	244 MHz

1.6 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00779	Amp Inc. P.O. Box 3608 Harrisburg, PA 17105
01295	Texas Instruments, Inc. Semiconductor-Components Div. 13500 North Central Expressway Dallas, TX 75231
02114	Ferroxcube Corp. P.O. Box 359 Mt. Marion Road Saugerties, NY 12477
02735	RCA Corporation Solid State Division Route 202 Somerville, NJ 08876
05397	Union Carbide Corp. 11901 Madison Avenue Cleveland, OH 44101
07263	Fairchild Camera & Intr. Corp. Semiconductor Division 464 Ellis Street Mt. View, CA 94040
09021	Airco Electronics Bradford, PA 16701
14482	Watkins-Johnson Company 3333 Hillview Avenue Palo Alto, CA 94304
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878
18736	Voltronics Corporation West Street Hanover, NJ 07936
19505	Applied Engineering Products 300 Seymour Avenue Derby, CT 06418
24539	Avantek, Incorporation 3175 Bowers Avenue Santa Clara, CA 95051
27014	National Semi-Conductor Corp. 2950 San Ysidro Way Santa Clara, CA 95051
27956	Relcom 3333 Hillview Avenue Palo Alto, CA 94304
28480	Hewlett-Packard Comp. 1501 Page Mill Road Palo Alto, CA 94304
29990	American Technical Ceramics 1 Norden Lane Huntington Station, NY 11746
31091	Alpha Industries Inc. Advance Lane Colmar, PA 18915
31433	Union Carbide Corp. P.O. Box 5928 Greenville, SC 29606
33095	Spectrum Control Inc. 152 E. Main Street Fairview, PA 16415
34731	Lakeside Bridge and Steel Co. 5303 N. 33rd Street Milwaukee, WI 53209
50101	Frequency Sources Inc. 16 Maple Road South Chelmsford, MA 01824
50140	K and L Microwave, Inc. 203 Newton Street Salisbury, MD 21801

Mfr. Code	Name and Address
52648	Plessey Semiconductors 1641 Kaiser Irvine, CA 92714
55969	Metuchen Capacitors Inc. 420 Park Avenue Perth Amboy, NJ 08861
56289	Sprague Electric Company Marshall Street North Adams, MA 01247
57856	Aero American Inc. 7830 Balboa Boulevard Van Nuys, CA 91406
59660	Tusonix Inc. 2155 N. Forbes Blvd., Suite 107 Tucson, AZ 85745
70903	Belden Corp. 415 South Kelpatrick Chicago, IL 60644
71279	Cambridge Thermionic Corp. 445 Concord Ave. Cambridge, MA 02138
73138	Beckman Instruments, Inc. 2500 Harbor Boulevard Fullerton, CA 92634
75037	Minnesota Mining & Manuf. Comp. 3 M Center St. Paul, MN 55101
76055	Mallory Control Division P.O. Box 327 State Road 28W Frankfort, IN 46041
80131	Electronics Industries Assoc. 2001 Eye Street, N.W. Washington, DC 20006
81312	Winchester Electronics Division Litton Industries Main Street and Hillside Ave. Oakville, CT 06779
81349	Military Specifications
91418	Radio Materials Comp. 4242 West Bryn Mauer Ave. Chicago, IL 60646
91506	Augat Incorporated 33 Perry Ave. Attleboro, MA 02703
96341	Microwave Assoc., Inc. South Avenue Burlington, MA 01803
98291	Sealectro Corp. 225 Hoyt Mamaroneck, NY 10544
99800	American Precision Ind. Delevan Electronics Div. 270 Quaker Road East Aurora, NY 14052

1.7 REPLACEMENT PARTS LIST

The following parts list contains all the electrical components and certain mechanical parts, subject to unusual wear or possible damage, used in the Frequency Extender Option. The List of Manufacturers provided in **paragraph 1.6**, and the manufacturer's component part numbers are included as an aid for the equipment user in the field. The listed parts may not necessarily agree with the components installed; however, the listed parts can be used and will provide satisfactory equipment operation. Replacement parts may be obtained from any manufacturer, as long as the physical and electrical parameters of the replacement part agree with the original part.

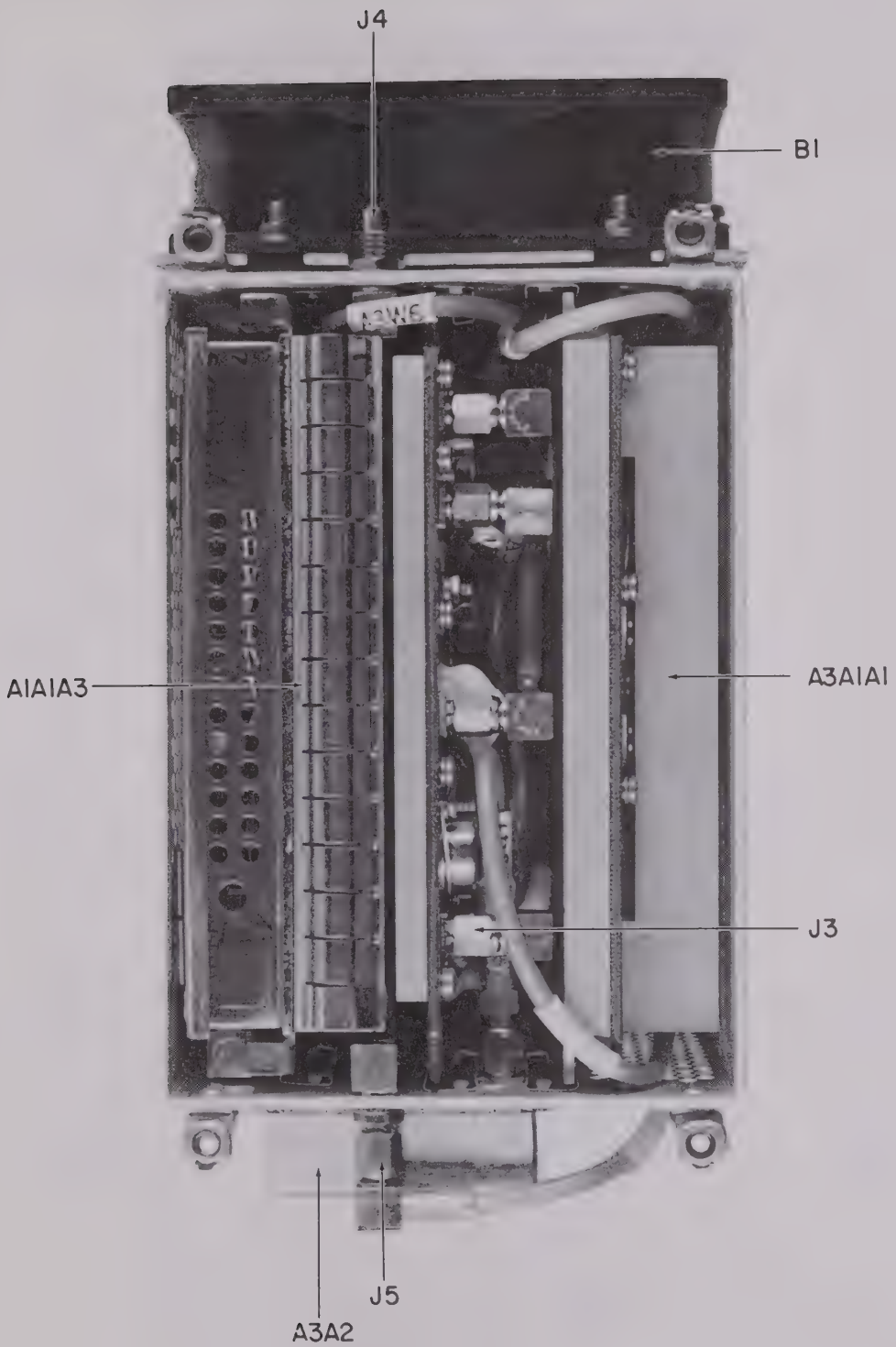


Figure 1-2. WJ-8615 FE Left Side Component View

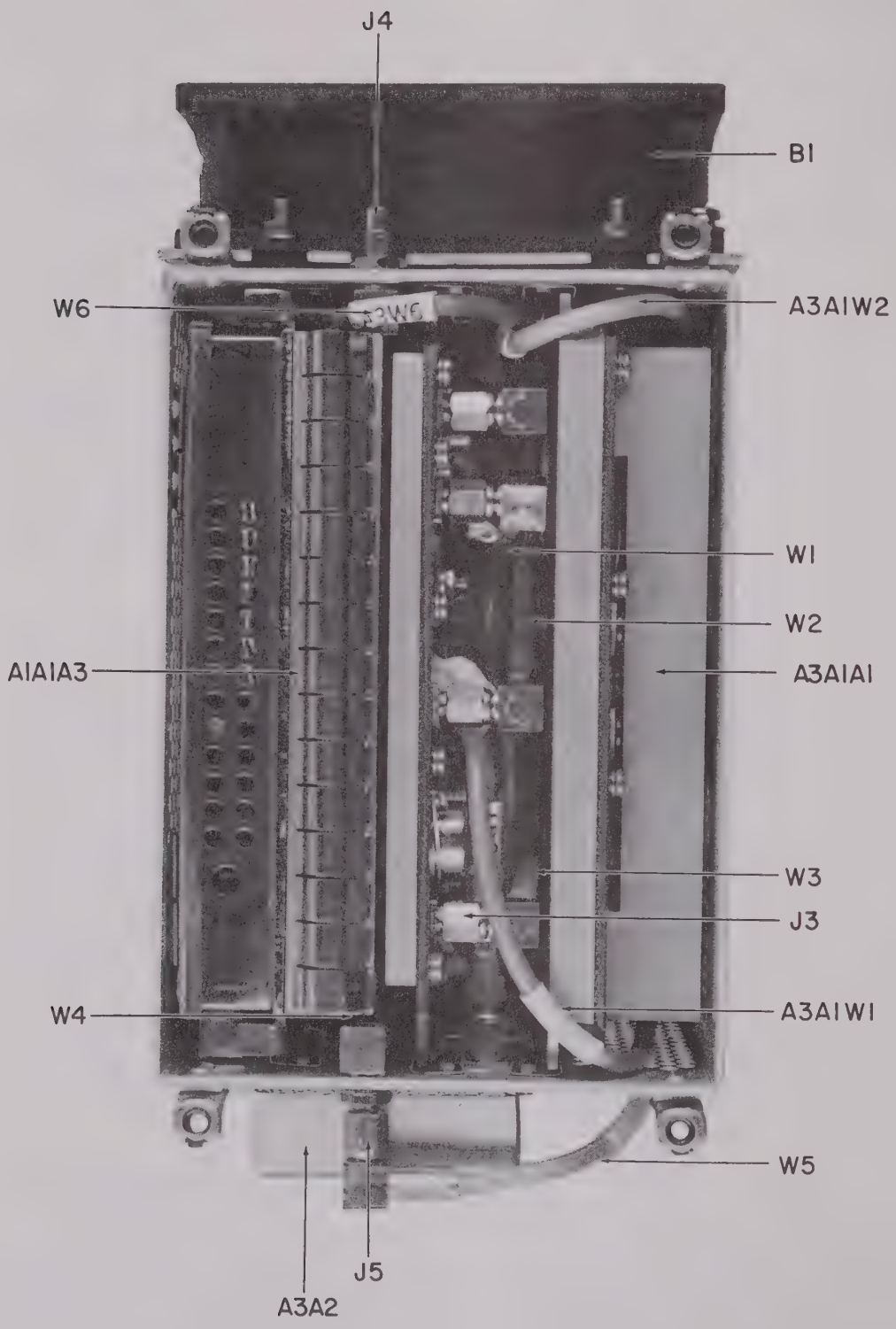


Figure 1-3. WJ-8615 FE Right Side Component View

1.7.1 **TYPE 796456-1 FREQUENCY EXTENDER** REF DESIG PREFIX **A3**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A3A1	Motherboard	1	380762-1	14632	
A3A2	RF Switch	1	280899-1	14632	
A3A1A1	UHF Preselector Module Assembly	1	796414-1	14632	
A3A1A2	UHF Preamplifier/Mixer Module Assembly	1	796415-1	14632	
A3A1A3	UHF LO Synthesizer Module Assembly	1	798079-2	14632	
C1	Capacitor, Ceramic, Feedthru: 0.05 µF, 300 V	9	54-785-005-503P	33095	
C2 Thru C9	Same as C1				
FB1	Ferrite Bead	20	56-590-65-4A	02114	
FB2 Thru FB20	Same as FB1				
J1	Connector, Receptacle	1	17-0204-000	19505	
J2	Connector, Jack	1	50-047-0000	98291	
J3	Connector, Receptacle	1	UG1464U	19505	
J4	Connector, Plug	2	50-330-0039-91	98291	
J5	Same as J4				
P1	Connector, Plug	2	87499-1	00779	
P2	Same as P1				
P3	Connector, Plug	5	50-328-3875-91	98291	
P4	Same as P3				
P5	Same as P3				
P7	Connector, Plug	2	50-024-3875-91	98291	
P8	Same as P7				
P9	Same as P3				
P10	Same as P3				
P11	Connector, Plug	1	2105-7521-005	19505	
W1	Cable Assembly	1	380535-7	14632	
W2	Cable Assembly	1	380535-2	14632	
W3	Cable Assembly	1	380535-3	14632	
W4	Cable Assembly	1	380535-4	14632	
W5	Cable Assembly	1	380535-5	14632	
W6	Cable Assembly	1	380535-6	14632	

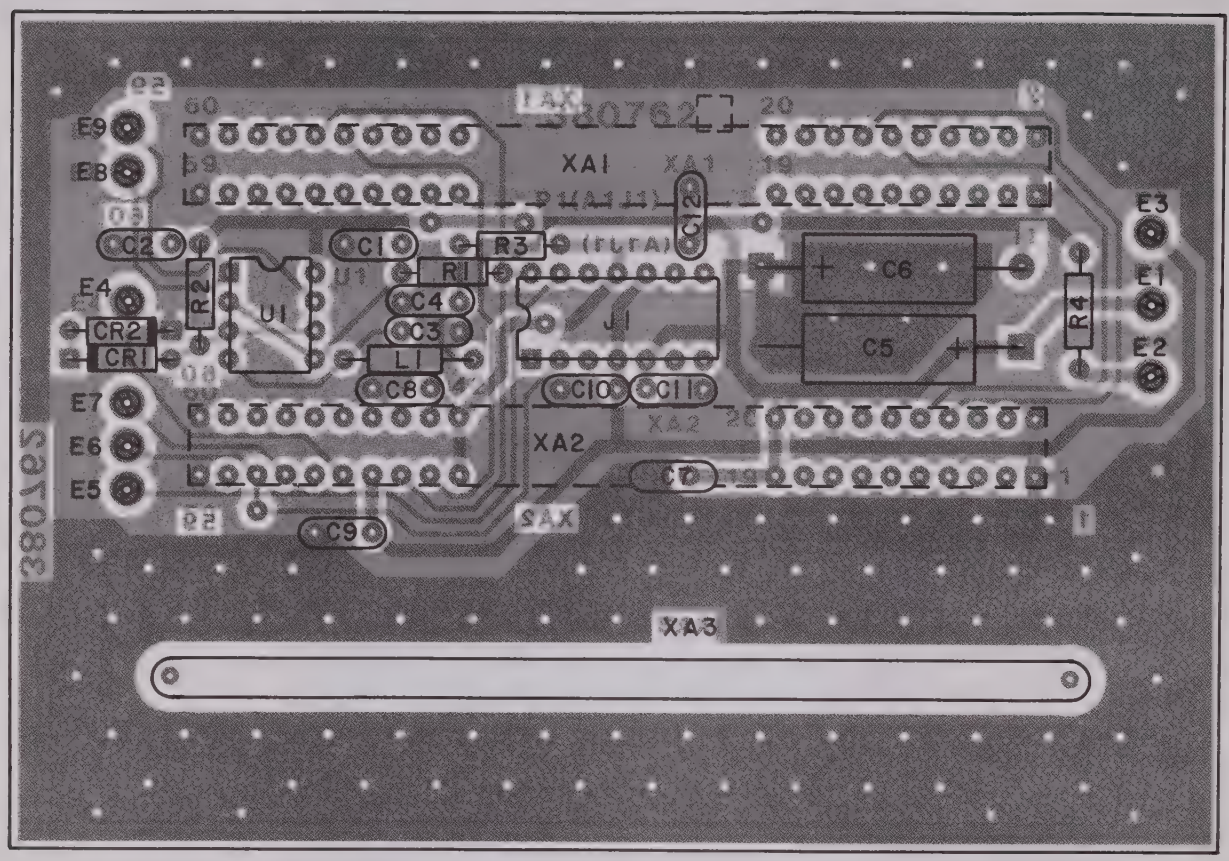


Figure 1-4. Type 380762-1 Motherboard (A3A1), Location of Components

1.7.1.1 **Type 380762-1 Motherboard** REF DESIG PREFIX **A3A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	UHF Preselector	1	796414-1	14632	
A2	UHF Preamplifier, Mixer	1	796415-1	14632	
A3	UHF LO Synthesizer	1	798079-2	14632	
C1	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	3	34475-1	14632	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	1	34452-1	14632	
C5	Capacitor, Electrolytic, Tantalum: 100 µF, 20%, 35 V	2	MTP107M035P1C	76055	
C6	Same as C5				
C7	Capacitor, Ceramic, Disc: .01 µF, 20%, 50 V	6	34453-1	14632	
C8 Thru C12	Same as C7				
CR1	Diode	2	1N4446	80131	
CR2	Same as CR1				
E1	Terminal, Forked	9	140-1941-03-01	71279	
E2 Thru E9	Same as E1				
J1	Socket, IC	1	514-AG10D	91506	
L1	Coil, Fixed: 0.47 µH	1	1025-12	99800	
P1	Connector, Plug	1	3406-0002	75037	
R1	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	1	CF1/8-1.0K/J	09021	
R2	Resistor, Fixed, Film: 5.1 kΩ, 5%, 1/8 W	1	CF1/8-5.1K/J	09021	
R3	Resistor, Fixed, Film: 180Ω 5%, 1/8 W	1	CF1/8-180 OHMS/J	09021	
R4	Resistor, Fixed, Film: 7.5Ω, 5%, 1/4W	1	CF1/4-7.5 OHMS/J	09021	
U1	Integrated Circuit	1	LM358N	27014	
W1	Cable Assembly	1	380532-1	14632	
XA1	Housing	2	MK30C-13-195-4381	81312	
XA2	Same as XA1				
XA3	Connector, Receptacle, Multipin	1	RF30-2801-5	57856	

1.7.1.1.1 **Type 796414-1 UHF Preselector** REF DESIG PREFIX **A3A1A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	2	C1210E471K1GAH	31433	
C2 Thru C5	Not Used				
C6	Capacitor, Ceramic, Monolithic: 220 pF, 5%, 100 V	6	8121-100-C0G0-221J	59660	
C7 Thru C11	Same as C6				
C12	Same as C1				
C13	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	3	34475-1	14632	
C14	Capacitor, Ceramic, Disc: 1000 pF, 500 V	3	B-GP1000PFP	91418	
C15	Same as C13				
C16	Same as C14				
C17	Same as C13				
C18	Same as C14				
CR1	Diode Pin	6	GC4371-15	50101	
CR2	Diode Pin	6	GC4212-15	50101	
CR3	Same as CR2				
CR4	Same as CR1				
CR5	Same as CR1				
CR6	Same as CR2				
CR7	Same as CR2				
CR8	Same as CR1				
CR9	Same as CR1				
CR10	Diode	2	MA47201	96341	
CR11	Same as CR10				
CR12	Same as CR1				
CR13	Same as CR2				
CR14	Same as CR2				
E1	Connector, Terminal	2	55-039-3875-91	98291	
E2	Same as E1				
E3	Terminal, Forked	6	140-1941-02-01	71279	
E4 Thru E8	Same as E3				
E9	Not Used				
E10	Not Used				
E11	Same as E3				
E12	Same as E3				
FB1	Not Used				
FB2	Not Used				

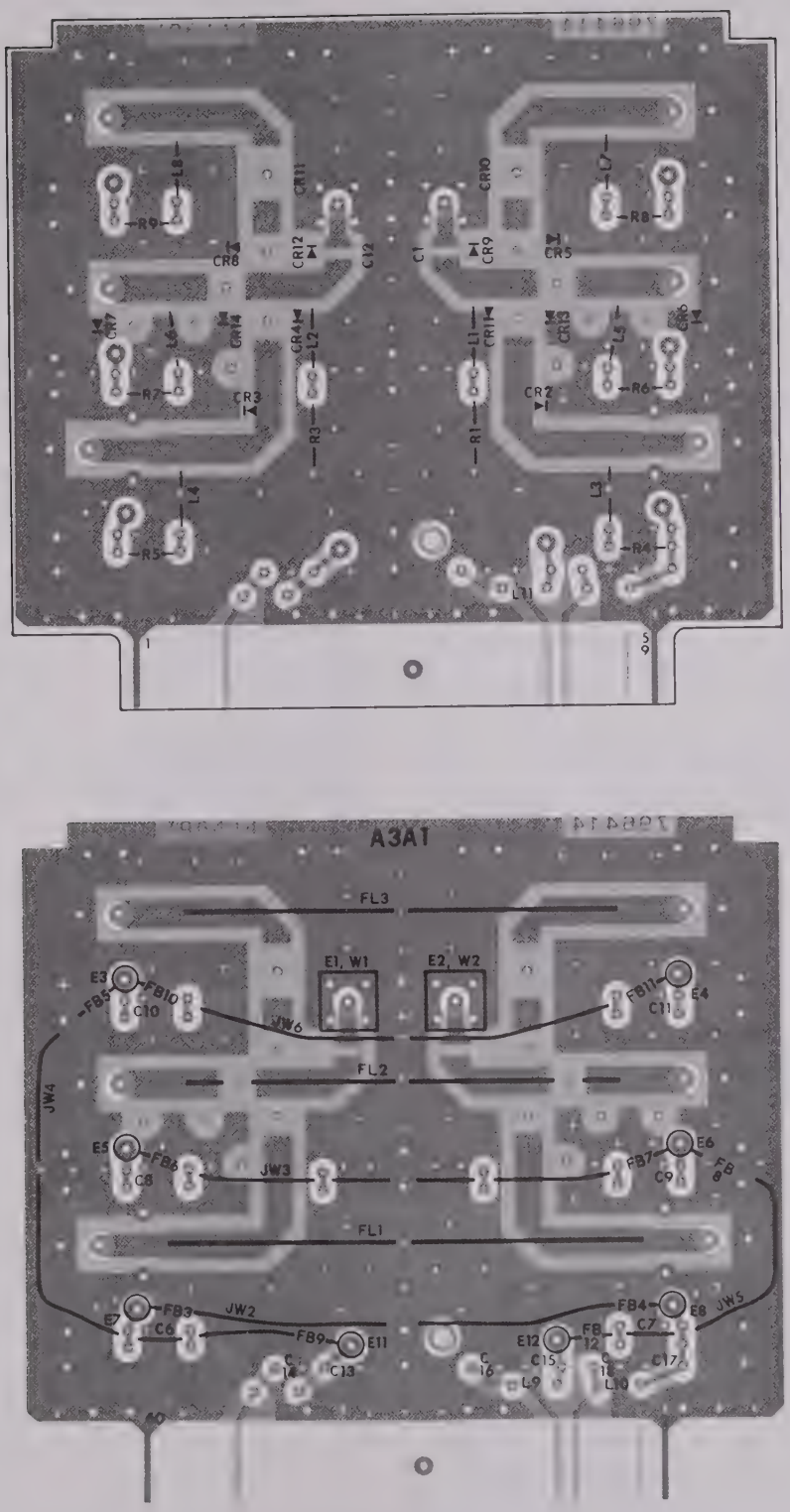


Figure 1-5. Type 796414-1, UHF Preselector (A3A1A1), Location of Components

REF DESIG PREFIX **A3A1A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
FB3	Ferrite Bead	10	56-590-65-4A	02114	
FB4 Thru FB12	Same as FB3				
FL1	Filter, Bandpass: 600 MHz CF, 200 MHz Bandwidth	1	92222	50140	
FL2	Filter, Bandpass: 800 MHz CF, 200 MHz Bandwidth	1	92223	50140	
FL3	Filter, Bandpass: 1000 MHz CF, 200 MHz Bandwidth	1	92224	50140	
JW1	Not Used				
JW2	Wire, Electronic, Buss, Bus Wire	AR	8022 24AWG Busswire	70903	
JW3 Thru JW6	Same as JW2				
L1	Coil, Fixed	8	170134-1	14632	
L2 Thru L8	Same as L1				
L9	Coil, Fixed	3	190187-1	14632	
L10	Same as L9				
L11	Same as L9				
P1	Connector, Plug	1	50-024-3875-91	98291	
P2	Connector, Plug	1	50-328-3875-91	98291	
R1	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/4 W	2	CF1/4-1.2K/J	09021	
R2	Not Used				
R3	Same as R1				
R4	Resistor, Fixed, Composition: 470Ω, 5%, 1/8 W	6	RCR05G471JS	81349	
R5 Thru R9	Same as R4				
W1	Cable Assembly	1	17300-188-3	14632	
W2	Cable Assembly	1	17300-188-4	14632	

1.7.1.1.2 **Type 796415-1 UHF Preamplifier/Mixer** REF DESIG PREFIX **A3A1A2**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	2	196D475X0035JE3	56289	
C2	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	15	34475-1	14632	
C3	Same as C1				
C4 Thru C15	Same as C2				
C16	Capacitor, Ceramic, Monolithic: 470 pF, 5%, 100 V	3	8121-100-C0G0-471J	59660	
C17	Same as C16				
C18	Same as C2				
C19	Same as C2				
C20	Capacitor, Ceramic, Disc: 1000 pF, 10%, 100 V	2	8121-100-X7R0-102K	59660	
C21	Same as C20				
C22	Capacitor, Ceramic, Chip: 220 pF, 10%, 50 V	1	C1210C221K5GAH	05397	
C23	Capacitor, Ceramic, Chip: .05 µF, 10%, 50 V	2	1210-050-X7R-503K5	55969	
C24	Same as C23				
C25	Same as C16				
C26	Capacitor, Ceramic, Chip: 4.3 pF, 0.5%, 500 V	2	ATC700B4R3DP500X	29990	
C27	Same as C26				
C28	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	1	C1210E471K1GAH	31433	
C29	Capacitor, Variable, Air: 0.6-4.5 pF, 500 V	1	M5F	18736	
CR1	Diode	2	1N4446	80131	
CR2	Same as CR1				
CR3	Diode, Pin	2	GC4212-15	50101	
CR4	Diode, Pin	2	GC4371-15	50101	
CR5	Same as CR4				
CR6	Diode, Pin	1	5082-3046	28480	
CR7	Not Used				
CR8	Same as CR3				
FL1	Filter Low Pass: 1100 MHz	1	92225	50140	
J1	Connector, Receptacle	4	1009-7511-000	19505	
J2	Same as J1				
J3	Same as J1				
J4	Same as J1				
JW1	Jumper Cable, Coax	1	190196-1	14632	
L1	Coil, Fixed	6	16209-12	14632	
L2 Thru L5	Same as L1				
L6	Coil, Fixed	2	170134-1	14632	
L7	Coil, Fixed	2	190187-1	14632	
L8	Same as L6				

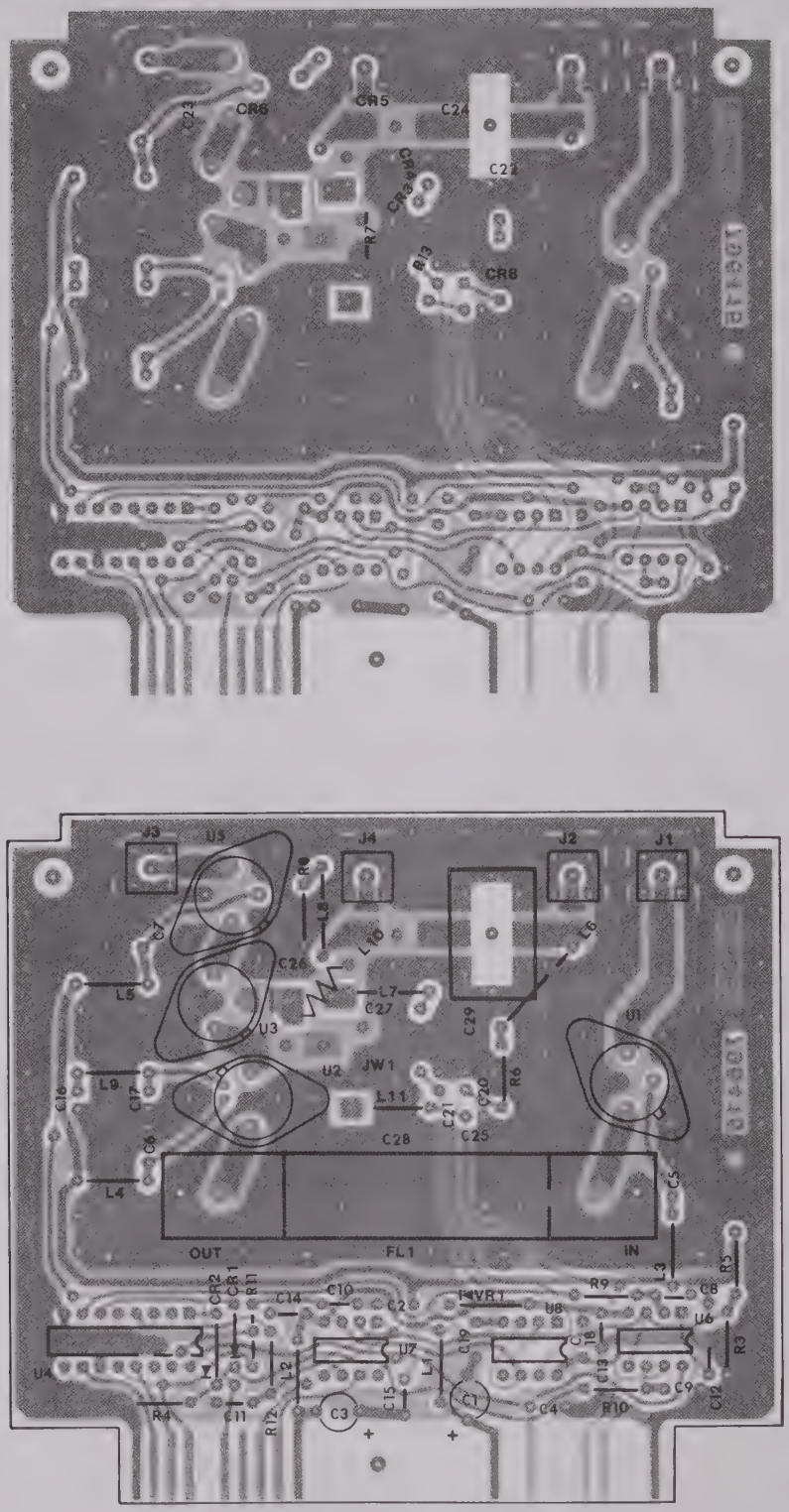


Figure 1-6. Type 796415-1, Preamplifier/Mixer (A3A1A2), Location of Components

REF DESIG PREFIX **A3A1A2**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L9	Same as L1				
L10	Coil, Fixed	1	170189-1	14632	
L11	Same as L7				
R1	Not Used				
R2	Not Used				
R3	Resistor, Fixed, Film: 1.8 kΩ, 5%, 1/8 W	2	CF1/8-1.8K/J	09021	
R4	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	1	CF1/8-47K/J	09021	
R5	Resistor, Fixed, Film: 12 kΩ, 5%, 1/8 W	1	CF1/8-12K/J	09021	
R6	Resistor, Fixed, Film: 680Ω, 5%, 1/8 W	2	CF1/8-690 OHMS/J	09021	
R7	Same as R6				
R8	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/8 W	1	CF1/8-1.2K/J	09021	
R9	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	4	CF1/8-18K/J	09021	
R10	Same as R9				
R11	Same as R9				
R12	Same as R9				
R13	Same as R3				
U1	Amplifier	1	A12	14482	
U2	Attenuator	1	G1	27956	
U3	Mixer, Balanced	1	M2A	27956	
U4	Integrated Circuit	1	CD4028AE	02735	
U5	Amplifier	1	AH28	31091	
U6	Integrated Circuit	3	LM358N	27014	
U7	Same as U6				
U8	Same as U6				
VR1	Diode, Zener: 5.1 V	1	1N751A	80131	

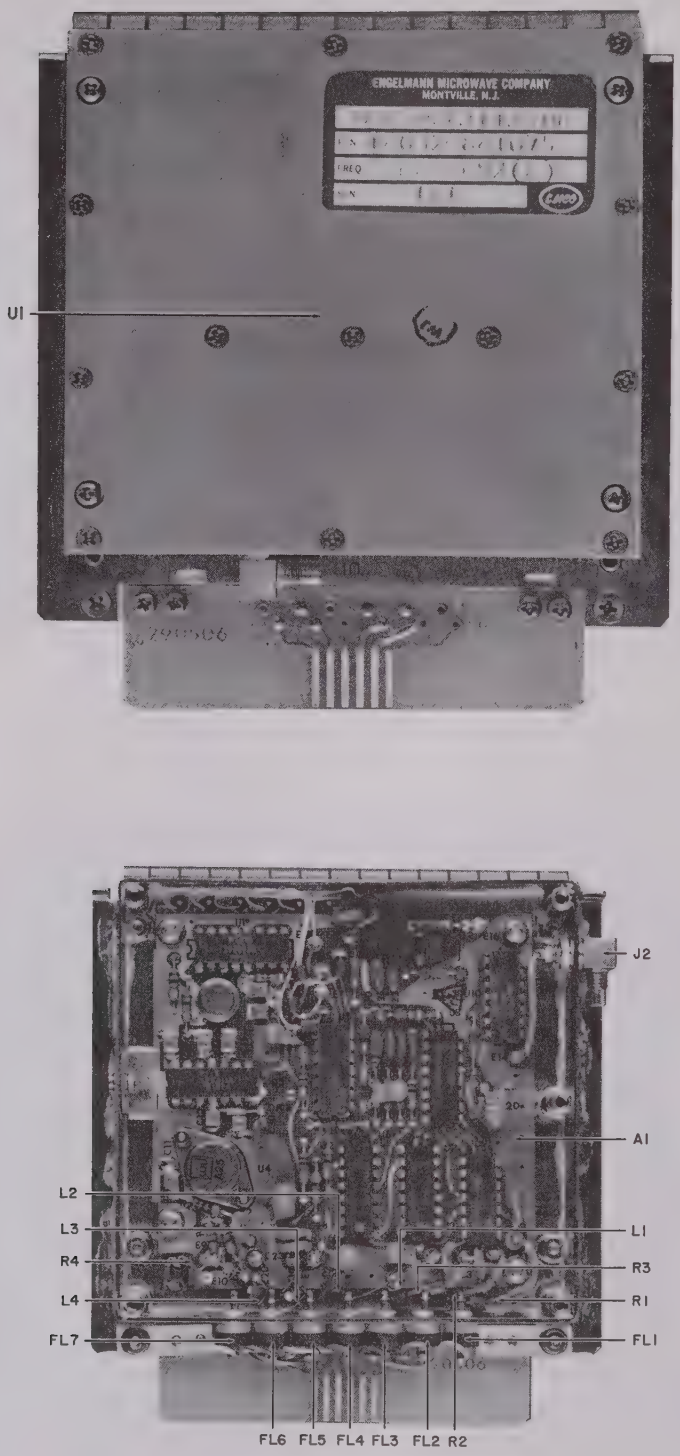


Figure 1-7. Type 798079-2 UHF LO Synthesizer (A3A1A3), Location of Components

1.7.1.1.3 **Type 798079-2 UHF LO Synthesizer** REF DESIG PREFIX **A3A1A3**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	UHF Variable Divider	1	390421-1	14632	
FB1	Ferrite Bead	12	56-590-65/4A	02114	
FB2 Thru FB12	Same as FB1				
FL1	Filter, Modified	7	33728-18	14632	
FL2 Thru FL7	Same as FL1				
J1	Not Used				
J2	Connector, Receptacle	1	1012-1511-000	19505	
L1	Coil, Fixed	4	16209-4	14632	
L2	Same as L1				
L3	Same as L1				
L4	Same as L1				
R1	Resistor, Fixed, Film: 270Ω, 5%, 1/8 W	3	CF1/8-270 OHMS/J	09021	
R2	Same as R1				
R3	Same as R1				
R4	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R5	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	1	CF1/8-100 OHMS/J	09021	
U1	UHF VCO Oscillator	1	280217-1	14632	

1.7.1.1.3.1 **Type 390421-1 UHF Variable Divider** REF DESIG PREFIX **A3A1A3A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Disc: 470 pF, 20%, 1000 V	7	B470PFM	91418	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, Disc: 0.01 µF, 20%, 50 V	6	34453-1	14632	
C5	Same as C4				
C6	Same as C4				
C7	Same as C4				
C8	Capacitor, Electrolytic, Tantalum: 4.7 µF, 20%, 35 V	5	196D475X0035JE3	56289	
C9	Same as C8				
C10	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	1	34475-1	14632	
C11	Capacitor, Ceramic, Chip: 470 pF, 10%, 100 V	9	C1210E471K1GAH	31433	
C12 Thru C18	Same as C11				
C19	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	2	34452-1	14632	
C20	Same as C8				
C21	Same as C19				
C22	Same as C4				
C23	Same as C1				
C24	Capacitor, Electrolytic, Tantalum: 22 µF, 20%, 10 V	1	196D226X0010JE3	56289	
C25	Same as C1				
C26	Same as C8				
C27	Same as C8				
C28	Same as C1				
C29	Same as C1				
C30	Same as C4				
C31	Same as C11				
CR1	Diode	1	GC4211-15	50101	
E1	Terminal, Forked	17	140-1941-02-01	71279	
E2 Thru E7	Same as E1				
E8	Not Used				
E9 Thru E11	Same as E1				
E12	Not Used				
E13	Same as E1				
E14	Same as E1				
E15	Not Used				
L1	Coil, Fixed: 0.18 µH, 10%	1	1025-02	99800	
Q1	Transistor	2	2N3904	80131	
Q2	Same as Q1				

REF DESIG PREFIX **A3A1A3A1**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R1	Resistor, Fixed, Film: 10 kΩ, 5%, 1/4 W	7	CF1/4-10K/J	09021	
R2 Thru R6	Same as R1				
R7	Resistor, Fixed, Film: 27Ω, 5%, 1/4 W	1	CF1/4-27 OHMS/J	09021	
R8	Resistor, Fixed, Film: 100Ω, 5%, 1/4 W	2	CF1/4-100 OHMS/J	09021	
R9	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R10	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	1	CF1/8-47 OHMS/J	09021	
R11	Resistor, Fixed, Film: 100Ω, 5%, 1/8W	1	CF1/8-100 OHMS/J	09021	
R12	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/4 W	3	CF1/4-1K/J	09021	
R13	Resistor, Fixed, Film: 15 kΩ, 5%, 1/4 W	1	CF1/4-15K/J	09021	
R14	Resistor, Fixed, Film: 3.6 kΩ, 5%, 1/4 W	1	CF1/4-3.6K/J	09021	
R15	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/4 W	1	CF1/4-1.5K/J	09021	
R16	Same as R12				
R17	Resistor, Fixed, Film: 330Ω, 5%, 1/4 W	1	CF1/4-330 OHMS/J	09021	
R18	Same as R12				
R19	Resistor, Trimmer, Film: 2 kΩ, 10%, 1/2 W	1	62PAR2K	73138	
R20	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/4 W	1	CF1/4-3.3K/J	09021	
R21	Same as R1				
R22	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/4 W	1	CF1/4-4.7K/J	09021	
R23	Same as R8				
R24	Resistor, Fixed, Film: 4.7 MΩ, 5%, 1/4 W	1	CF1/4-4.7M/J	09021	
U1	Integrated Circuit	1	SP8695B	52648	
U2	Integrated Circuit	1	SP8602B	52648	
U3	Integrated Circuit	1	SP8611B	52648	
U4	Amplifier	1	GPD-410	24539	
U5	Integrated Circuit	1	HA1-4741-5	34371	
U6	Integrated Circuit	2	SN74LS161AN	01295	
U7	Same as U6				
U8	Integrated Circuit	1	SN74LS138N	01295	
U9	Integrated Circuit	1	SN74LS04N	01295	
U10	Integrated Circuit	1	11C44DC	07263	

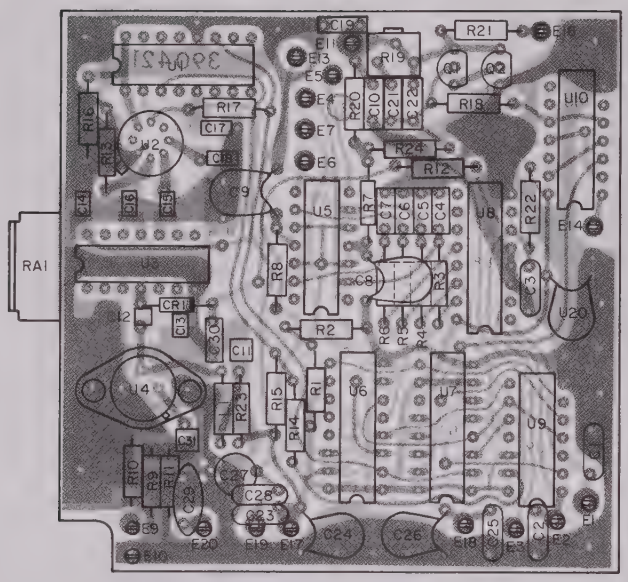


Figure 1-8. Type 390421 UHF Variable Divider, (A3A1A3A1) Location of Components

1.7.2 **TYPE 280899-1 RF SWITCH** REF DESIG PREFIX **A3A2**

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Chip: 4.3 pF, ±0.5 pF, 500 V	2	ATC700B4R3DP500X	29990	
C2	Capacitor, Ceramic, Chip: 2200 pF, 5%, 50 V	2	C1005C222J5GPH	31433	
C3	Capacitor, Ceramic, Chip: 0.05 µF, 10%, 50 V	2	1210-050-X7R-503KS	55969	
C4	Capacitor, Ceramic, Chip: 8.2 pF, ±0.25 pF, 500 V	2	ATC700B8R2CP500X	29990	
C5	Same as C1				
C6	Capacitor, Ceramic, Disc: 1000 pF, 10%, 100 V	2	8121-100-X7R0-102K	59660	
C7	Same as C3				
C8	Same as C6				
C9	Same as C2				
C10	Capacitor, Ceramic, Chip: 13 pF, 2%, 500 V	1	ATC700B130GP500X	29990	
C11	Capacitor, Ceramic, Chip: 10 pF, 2%, 500 V	1	ATC700B100GP500X	29990	
C12	Capacitor, Ceramic, Chip: 4.7 pF, ±0.25 pF, 500 V	1	ATC700B4R7CP500X	29990	
C13	Capacitor, Ceramic, Chip: 33 pF, 2%, 500 V	1	ATC700B330GP500X	29990	
C14	Same as C4				
C15	Capacitor, Ceramic, Chip: 0.5 pF, ±0.1 pF, 500 V	1	ATC100B0R5BP500X	29990	
CR1	Diode	3	GC4212-15	50101	
CR2	Same as CR1				
CR3	Diode	2	GC4371-15	50101	
CR4	Same as CR3				
CR5	Same as CR1				
E1	Terminal, Forked	2	140-1941-02-01	71279	
E2	Same as E1				
J1	Connector, Receptacle	1	2110-7511-000	19505	
J2	Not Used				
J3	Connector, Receptacle	1	1009-7511-000	19505	
L1	Coil, Fixed	2	170160-1	14632	
L2	Same as L1				
L3	Coil, Fixed	3	170134-1	14632	
L4	Same as L3				
L5	Same as L3				
L6	Coil, Fixed	1	170158-1	14632	
L7	Coil, Fixed	1	170159-1	14632	
R1	Resistor, Fixed, Composition: 560Ω, 5%, 1/8 W	2	RCR05G561JS	81349	
R2	Resistor, Fixed, Composition: 680Ω, 5%, 1/4 W	1	RCR07G681JS	81349	
R3	Same as R1				

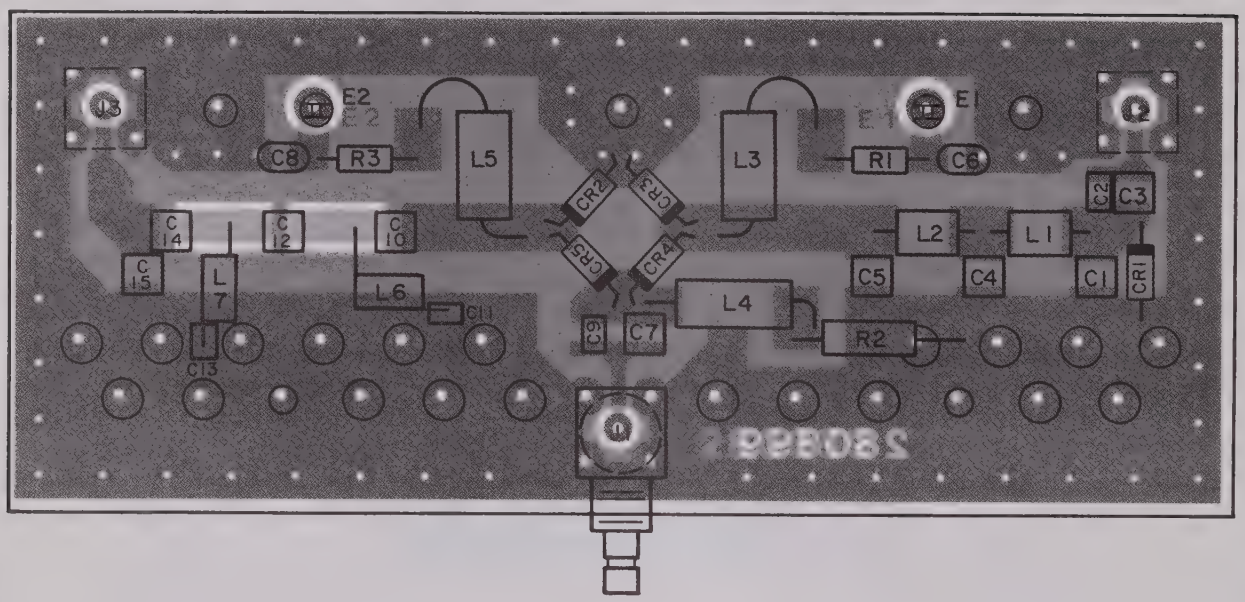


Figure 1-9. Type 280899-1 RF Switch (A3A2), Location of Components

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) CAPACITANCE IS IN μF.
   b) INDUCTANCE IS IN μH.
   c) RESISTANCE IS IN OHMS, ±5%, 1/8 W.

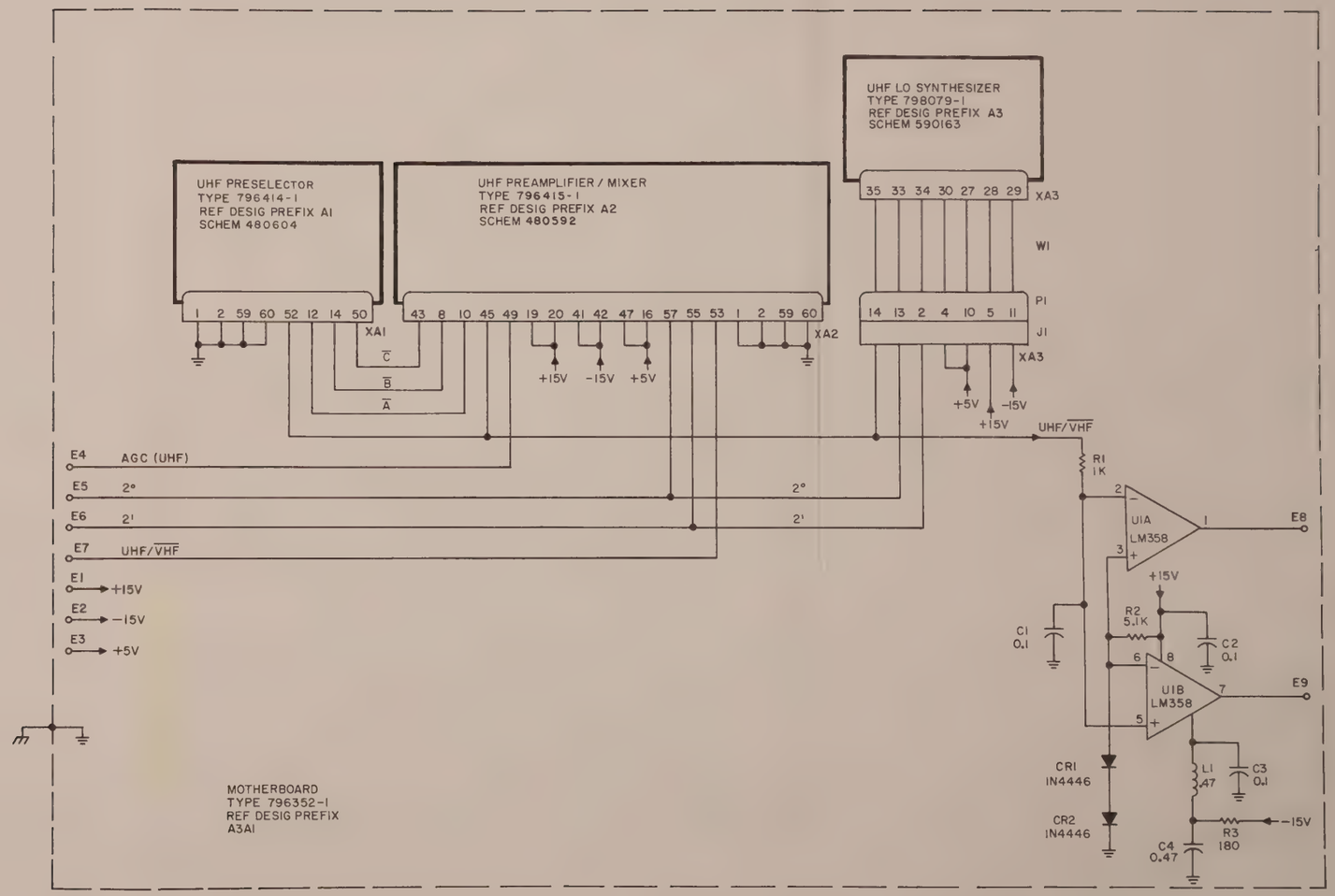


Figure 1-9. Type 796352-1 Motherboard (A3A1), Schematic Diagram 480504

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
   c) INDUCTANCE IS IN μH.
2. DIODES CR10, CR11 ARE MA-47201;
   CR1, CR4, CR5, CR8, CR9, CR12 ARE GC-4371-15;
   CR6, CR7, CR2, CR3, CR13, CR14 ARE GC-4212-15.

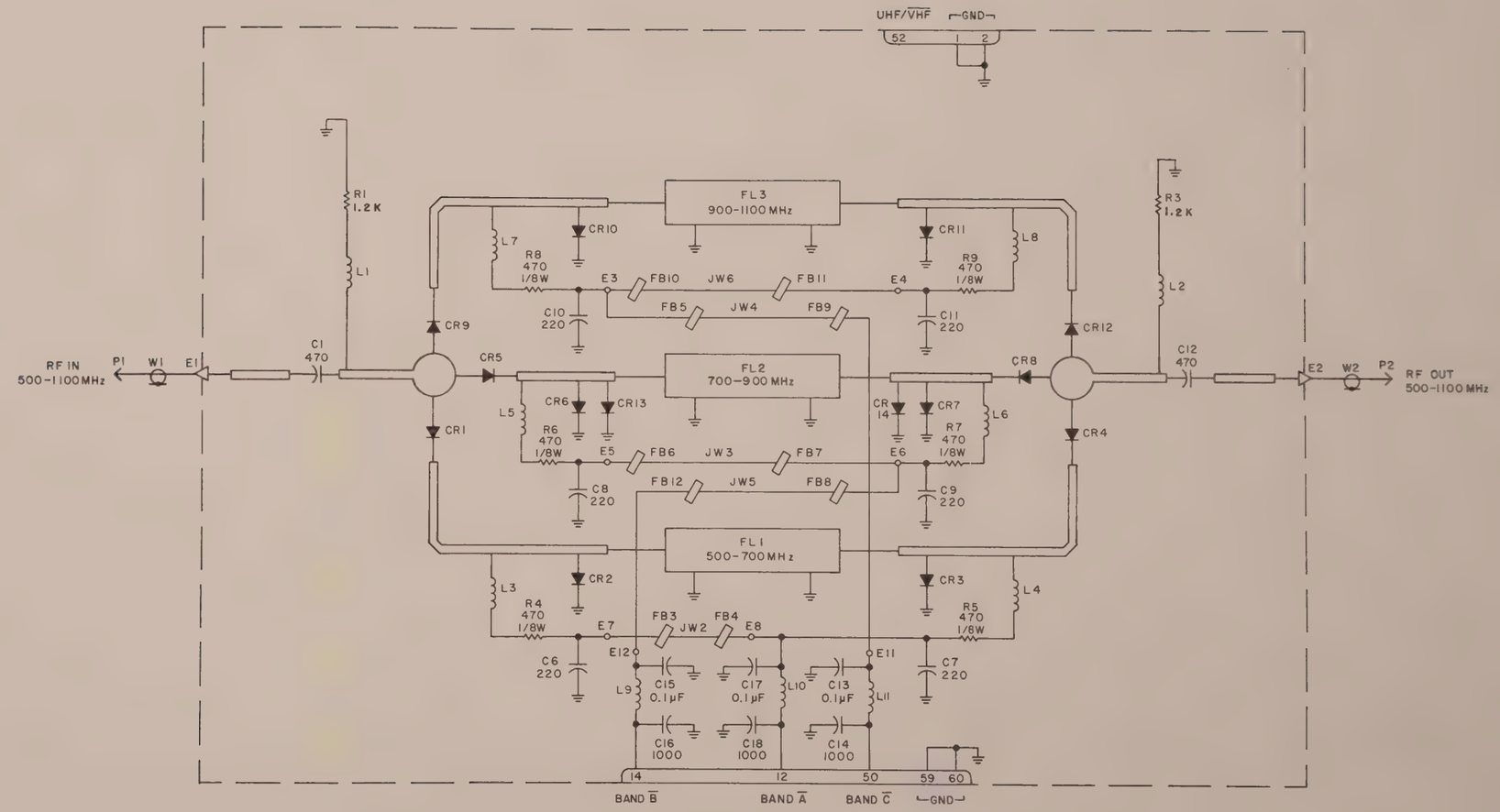


Figure 1-10. Type 796414-1 UHF Preselector (A3A1A1), Schematic Diagram 480604

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS ±5%, 1/8W.
   b) CAPACITANCE IS IN μF.

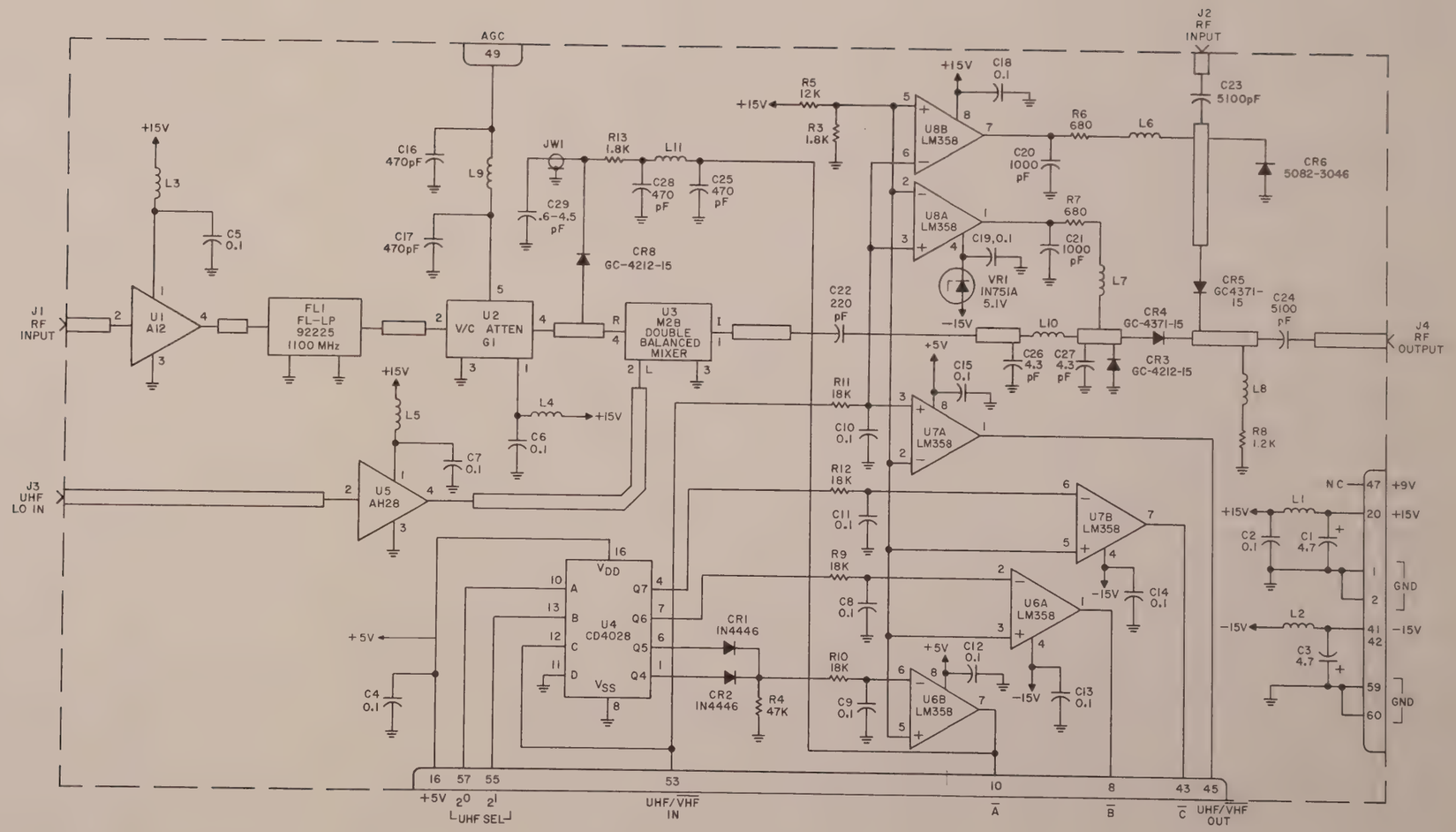


Figure 1—11. Type 796415-1 UHF Preamplifier/Mixer (A3A1A2), Schematic Diagram 480592

DETAIL A
WIRING TO CONNECTOR

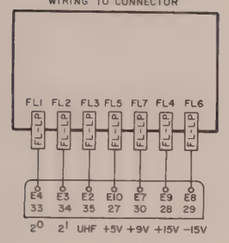
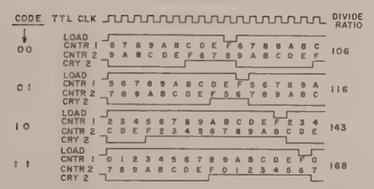


TABLE I

INPUTS UHF 2¹ 2⁰		CONTR 1 D C B A	CONTR 2 D C B A
1 0 0	→	0 1 1 0	1 0 0 1
1 0 1	→	0 1 0 1	0 1 1 1
1 1 0	→	0 0 1 0	1 1 0 0
1 1 1	→	0 0 0 0	0 1 1 1

TIMING DIAGRAM



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN pF.
2 DIFFERENCE BETWEEN TYPES IS MECHANICAL ONLY

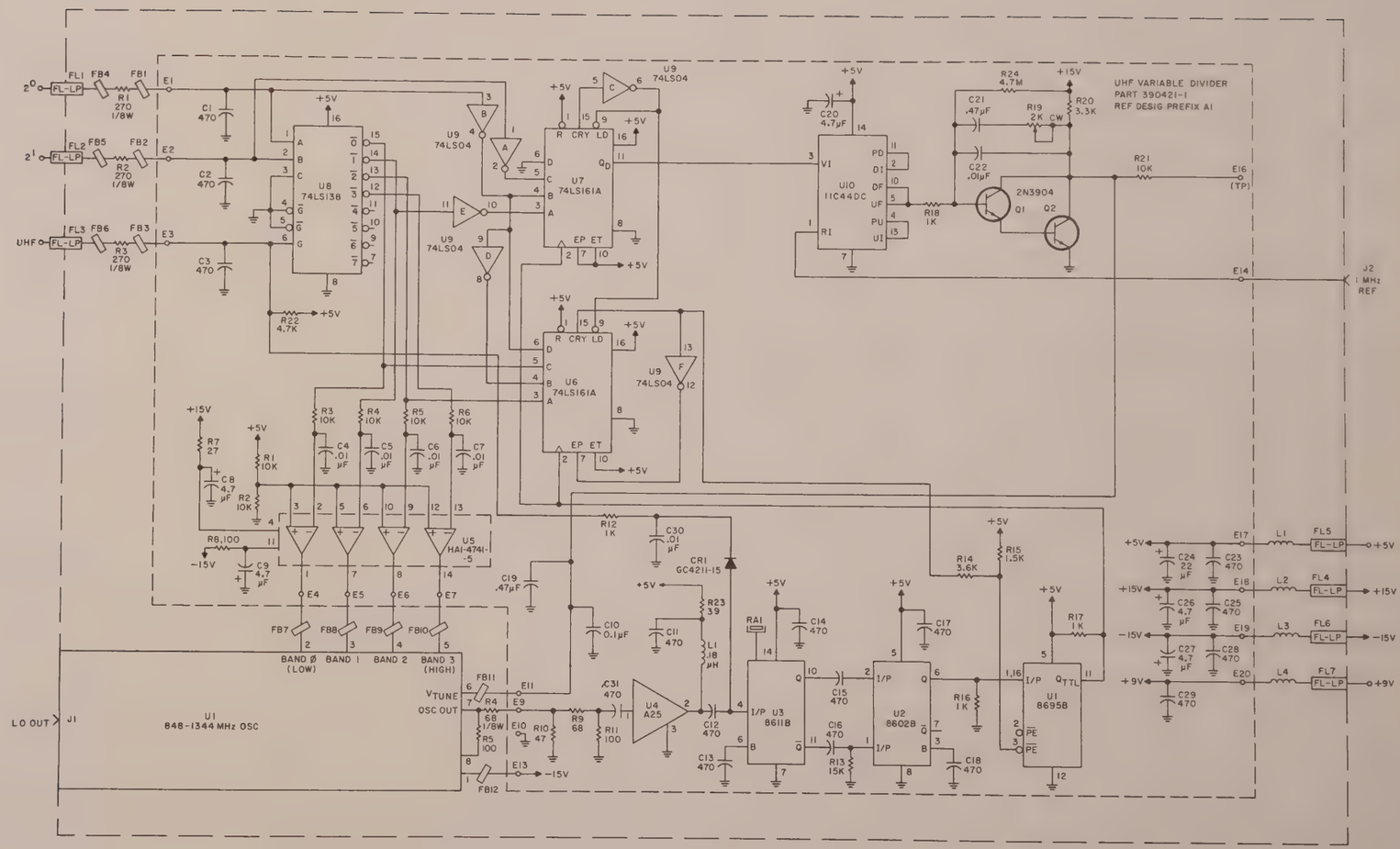


Figure 1-12. Type 798079-2 UHF LO Synthesizer (A3A1A3), Schematic Diagram 590163

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
   c) CAPACITANCE IS IN pF.
   d) INDUCTANCE IS IN nH.

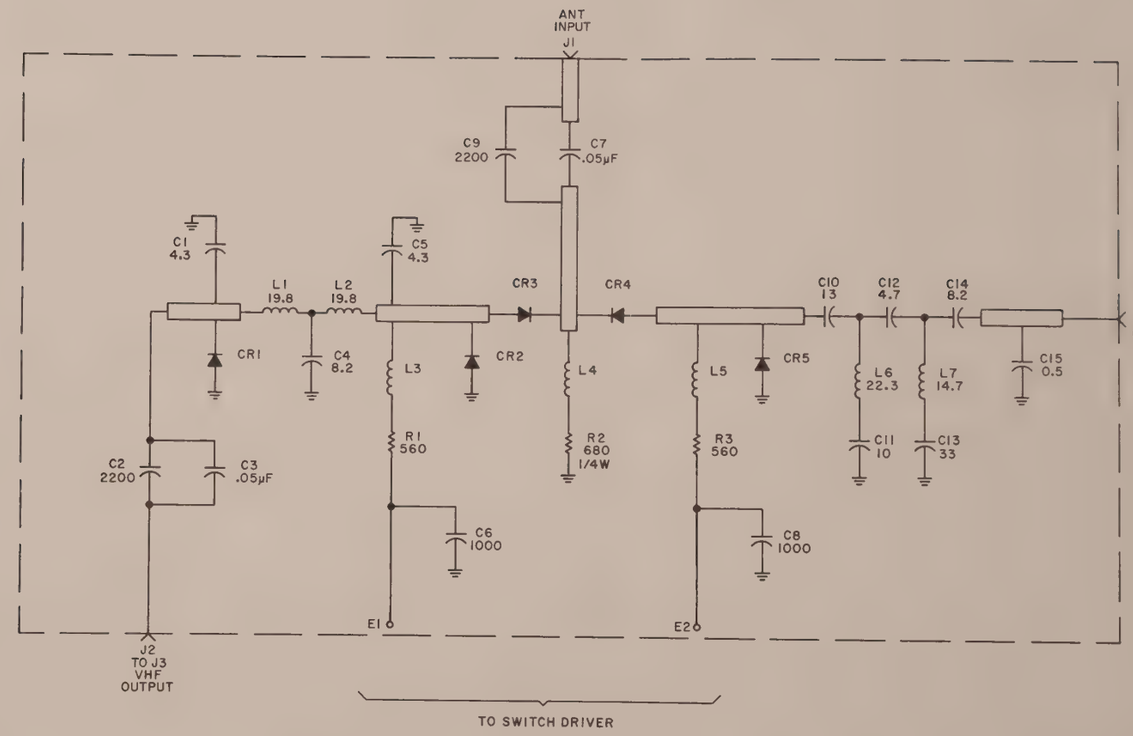
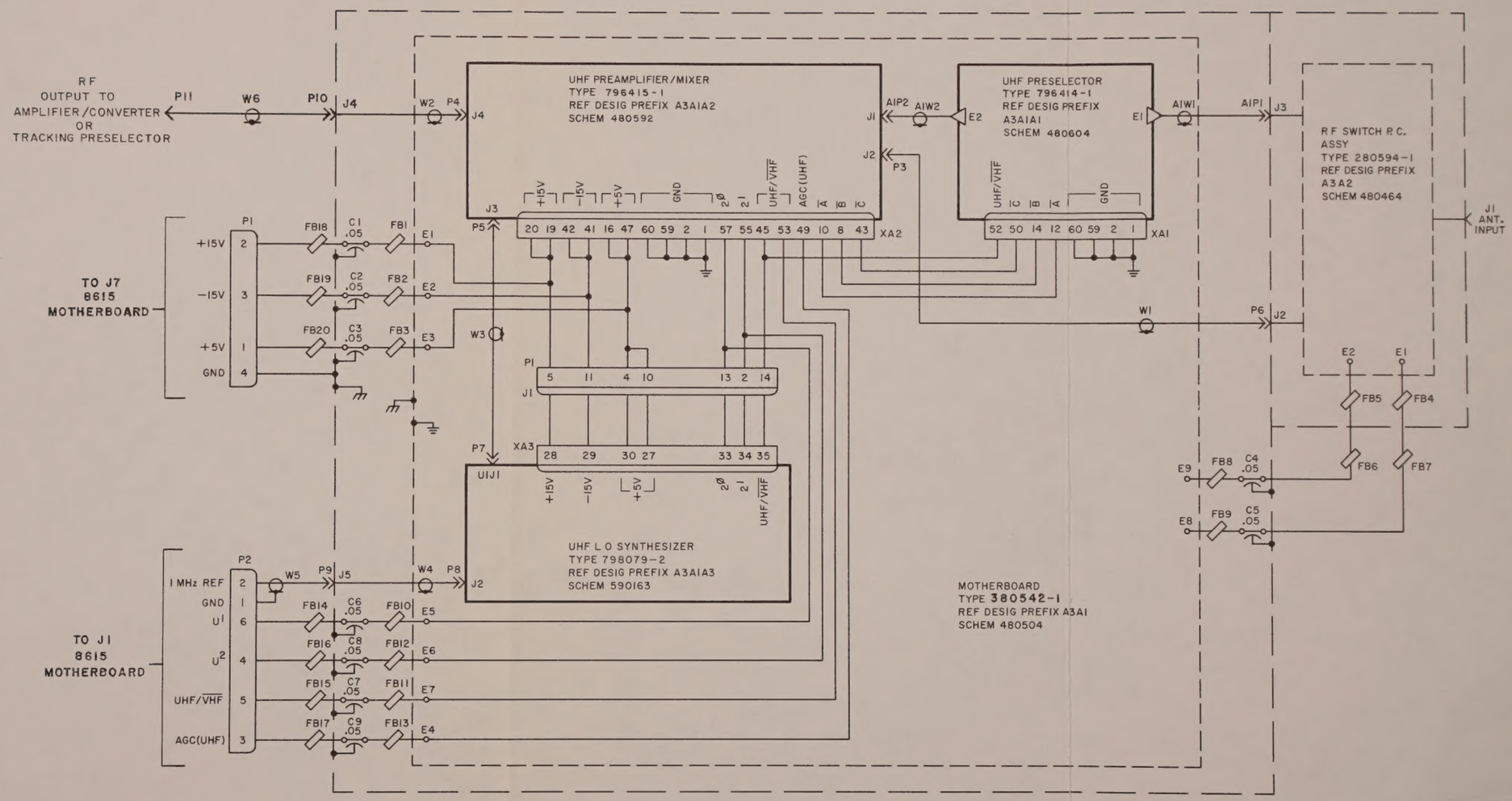


Figure 1-13. Type 280594-1 RF Switch (A3A2) Schematic Diagram 480464



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) CAPACITANCE IS IN μF.

FIGURE 1-14. WJ-8615 FREQUENCY EXTENDER MAIN CHASSIS SCHEMATIC DIAGRAM 480505

MP MASTER
MA29574